DOCUMENT RESUME

ED 117 153 TM 005 007

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TITLE Making Definitions Explicit and Capturing Evaluation Policies.
PUB DATE Apr 75
NOTE 11p.; Paper presented at the Annual Meeting of the American Educational Research Association (Washington, D.C., March 30-April 3, 1975)

EDRS PRICE MF-$0.76 HC-$1.58 Plus Postage
DESCRIPTORS Cluster Grouping; *Decision Making; Definitions; *Measurement Techniques; *Policy; Prediction; Program Evaluation; Rating Scales; Reliability; Research Proposals
IDENTIFIERS *Judgment Analysis

ABSTRACT

Judgment ANalysis (JAN) is described as a technique for identifying the rating policies that exist within a group of judges. Studies are presented in which JAN has been used in evaluating teacher effectiveness by capturing both student and faculty policies of teacher effectiveness at the University of Northern Colorado. In addition, research examples of the technique are presented in the area of making definitions explicit. Specifically, JAN was utilized as a methodology for defining what is pornographic for a group of lawyers, policemen and doctoral psychology students. (Author)

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MAKING DEFINITIONS EXPLICIT AND CAPTURING EVALUATION POLICIES*

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ABSTRACT

Judgment ANalysis (JAN) was presented as a technique for capturing policy(ies) present in a group of decision-makers. Several studies were described in which the JAN methodology was successfully utilized in capturing strategies of raters with respect to the responses to a set of complex stimuli. Examples were given which suggest that the JAN methodology was effective not only in the area of making definitions explicit but also in the evaluation of programs and research proposals.

1. Judgment Analysis

The objective of this paper is to describe a policy-capturing procedure, Judgment ANalysis (JAN), which can make explicit how judges (decision-makers) make decisions under a variety of conditions and to illustrate how the technique can be extended not only to the area of making definitions explicit but also to the evaluation of programs and research proposals.

A technique for both capturing and clustering raters' policies, Judgment Analysis (JAN), was suggested by Bottenberg and Christal (2) and Christal (4,5) and has been described in some detail by Houston and Stock (19). JAN utilizes a multiple regression model and a hierarchical grouping technique which clusters raters on the basis of the homogeneity of their raw score regression vectors (their prediction equations). In the use of JAN members of a group of decision-makers are required to rank or rate stimuli on a criterion. Results of JAN permit the identification of the rating policy (or policies) existing in the group or committee of judges and the number of clusters (and its members) of decision policies, if more than one policy, that exist for the total group. The end product is the systematic use of the resulting prediction equation or equations to simulate either group judgment or individual policy as well as to enable the investigator to make a complete analysis of interrater agreement.

The JAN procedure basically consists of two separate stages. During the first stage of the JAN process, a least-squares solution of a multiple regression equation for each rater separately is computed which predicts to some degree the criterion responses or decisions made by the judge. The results of stage one provide the investigator with the specification of each judge's policy (decision-making equation) and a measure of its reliability or consistency (R^2 value). Given a specific set of

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*Paper presented at American Educational Research Association, April, 1975.

independent variables the investigator is able, after stage one, to predict with a specific degree of confidence how a particular judge will make his decisions for a given set of profiles or stimuli. In other words, the question of whether the decision-makers are consistent in their use of independent variables as opposed to unreliable (a policy with decisions expressed in some stochastic fashion) can be answered from the results of stage one. In addition, a statement of the policy for each judge can be determined.

After the results from stage one are obtained, a hierarchical grouping procedure is initiated. This procedure allows the investigator to group individuals according to some objective function. In this case, groupings are sought which yield the smallest decrease in the ability of the system to predict the criterion responses from knowledge of the individuals who served as judges. The first step in the grouping procedure reduces the N equations (a separate equation for each of N judges) to N-1 equations. In the first reduction of equations, the two judges who are most alike in their policies are grouped together and all other judges remain ungrouped. The process continues in a systematic way reducing the number of judges by one at each step until all judges have been grouped into a single cluster. At each stage of the grouping an examination of the loss of predictive efficiency makes it possible to identify the different judgmental policies which exist. Results of JAN after stage two permit the identification of the rating policy (or policies) existing in the group or committee of judges and the number of clusters (and its members) of decision policies, if more than one policy, that exist for the total group. Policy equation (or equations) can then be used to simulate either group judgment or individual policy. The investigator can also make a complete analysis of interrater agreement. {See Ward and Jennings (29) for the full general linear model and successive restricted models necessary for the hierarchical clustering of judges at each stage of the JAN clustering.}

Often, after stage two, it is found that more than one policy exists in a group of decision-makers. If the primary purpose of the study is to develop a single joint or collective policy as opposed to analyze the several policies which may be present, the following course of action is recommended. Present to the decision-makers results from stage two, i.e., make explicit the different policies which were captured and identified by means of the JAN technique. Have the group of assembled decision-makers arbitrate the rating or rank responses on profiles in which disagreement has resulted in policy differences. The technique of arbitration of response decisions rather than of the weighings applied to the independent variables is one of the powerful aspects of this technique. Once an arbitration of the response decisions has been accomplished, a single joint policy may be obtained by regressing the arbitrated responses on the set of independent variables. {See Christal (4, 5) who discusses this aspect of the procedure in greater detail.}

2. General Applications of Judgment Analysis

JAN has already been demonstrated to be an extremely useful methodology for describing and capturing the strategies of raters with respect to the responses to a set of complex stimuli. JAN has been used in several studies conducted by the U.S. Air Force for job evaluations and to simulate officer promotion boards with a high degree of efficiency (4, 5). Equations have also been designed to simulate career counselors in making initial assignments of airmen graduating from basic training (5).

The JAN technique has been applied in a prediction study of success in graduate education. In this study two variations of JAN were investigated by Houston (13) and Roscoe and Houston (23)--Normative JAN and Ipsative JAN. The purpose of the Normative JAN study was to determine the extent to which a policy regarding graduate admission standards existed among selected graduate faculty members at Colorado State College (now University of Northern Colorado). Basically, three sets of independent profile variables were used: (1) biographical data, (2) test data, and (3) major subject field data. Results from the Normative JAN study indicated essentially one policy was present in the group of judges.

The Ipsative JAN study used for its dependent variable the rankings submitted by the judges who were requested to rank, without access to the three sets of independent profile variables used in the Normative JAN study, the doctoral graduates on the basis of a personal knowledge. It was the intent in this phase that the ratings or rankings be loaded with personality factors not readily available in the Normative JAN study. Results of this phase were statistically significant, though weak from a predictive standpoint. The practical significance of the Ipsative JAN study was in the suggestion of new directions for subsequent research.

Williams, Gab, and Linden (3) replicated Houston's Normative study at the University of North Dakota and sought to determine the policy of a university doctoral admissions board. Twelve members of the graduate faculty evaluated each graduate student's profile and replaced it into one of seven criterion categories (Q-Sort). Each rater's policy was assessed or captured and the raters were grouped into appropriate clusters by the JAN process. They found that at least two separate judgmental systems were present.

A further illustration of the versatility of the technique is provided in a study by Stock (24) who sought to determine if systematic differences existed in the placement policies for special education students among special education personnel (teachers, administrators, and members of the special education screening committee) responsible for placing the students in the public schools of Cheyenne, Wyoming. Coltvet (6) used JAN techniques in the identification and analysis of the consultant ratings of elementary student teachers at the University of Northern Colorado. The policies involved in the selection of faculty members at two small private colleges were investigated by Heim (11). Using JAN procedures, Chang (3) designed a study to determine whether individuals serving in different official capacities in the State of Colorado had differing attitudes toward selection criteria for awarding college financial grants. Keelan, et al. (21) captured the leadership policies of selected firemen in the State of Colorado with the use of JAN.

The policy-capturing methodology has been extended to cover the situation in which raters are required to make multidimensional rating responses, i.e., they must rank or rate each profile on more than one output dimension. Johnson and King (2) developed as part of a team dissertation a multivariate clustering procedure which captures multidimensional policies expressed by k-judges. The technique was identified as Canonical Judgment Analysis (C-JAN) and it represents an extension of Judgment Analysis procedures to two or more dimensions.

3. Making Definitions Explicit with JAN

For nearly as long as organized society has existed there has prevailed concern and confusion as to what is pornographic or obscene. This confusion has greatly increased in the United States in the last decade as a result of the vague and weakly defined decisions handed down by the Supreme Court. Because of these poorly framed decisions it is not surprising that most people, professional and lay, are uncertain as to what constitutes pornography. Dr. Joe Ward suggested that the JAN technique might be used in this controversial area to assist those confronted with making decisions about what is pornographic. J. Houston and S. Houston (2) used JAN as a methodology by testing this technique with three groups concerned with this issue. These groups included doctoral students majoring in Psychology, Counseling and Guidance at the University of Northern Colorado, lawyers and police officers from the city of Greeley, Colorado. Each judge (who served on a voluntary basis) was presented with a sample of 100 profiles, generated for this study by the investigators, descriptive of pictorial representations. Each judge was requested to rate each of the profiles on a five-point scale.

The instrument used to gather the data contained an 11-item profile for each of 100 pictorial representations. The 11 variables and a sample profile appears below:

Sample Profile of Pictorial Representation

Descriptors	Yes	No
1. Appeals to prurient interest		X
2. Goes beyond contemporary community standards		X
3. Has redeeming social importance	X	
4. Involves uncovered adult human genitalia		X
5. Displays human sexual intercourse		X
6. Displays masturbation		X
7. Displays anal intercourse	X	
8. Displays flagellation or torture	X	
9. Displays homosexuality		X
10. Involves interracial sexual relationships		X
11. Displays group sex activity		X

Judge's Rating (Circle only one) 1 2 3 4 5

Code

1. Should be banned from society
2. Allowed only for professional (medical and/or scientific) study
3. Available only to interested adults
4. Available to all adults
5. Unrestricted use in society

The reason for using 11 items on each profile and having 100 profiles available for each of the judges stems from the research conducted by Dudycha (9). More specifically, Dudycha found that it was difficult to cluster judges or raters when fewer than 100 observations existed. Further, Dudycha established that the clustering technique is far more effective when at least 10 predictor or profile items are used.

Each of the 100 profiles was generated by employing a table of random numbers. The table of random numbers was used to insure that the variables would not be systematically correlated; thus, the problem of multicollinearity would be avoided. This technique guaranteed also maximum variability in the distribution of profile descriptors, which is essential for the valid use of JAN.

The JAN technique proved to be surprisingly effective in capturing and clustering the policies (specific and complex) of the judges from the three groups identified. As expected, many policies were present. Although the process of identifying pornographic material is not a simple one, the JAN technique can be successfully utilized in capturing and explaining different policies regarding the pornographic content of material. Such a process as Judgment Analysis will at least open up a new frontier when psychologist, legal authorities, and government officials attempt to formulate policies regarding "what is pornographic and what is not." The investigators believe, however, that further investigations utilizing the JAN technique are needed. Such studies should involve a greater cross-section of professional and lay peoples, a larger geographic representation and a greater, more finite variety of pornographic material.

4. Evaluation Applications and JAN

The JAN methodology shows great promise in the area of education evaluation. The problem of evaluating curriculum packages was investigated by Torgunrud (25) in a doctoral dissertation completed at the University of California at Los Angeles. Torgunrud identified from the educational literature the following independent variables as important dimensions of any curriculum package or set of materials which are under consideration for possible adoption. These include: (1) valid and significant content (2) significant elements of organization, (3) sequence providing a cumulative effect, (4) integration providing horizontal relationships, (5) value position clearly stated, (6) specificity providing direction, (7) flexibility providing alternatives, (8) accommodation of student differences, (9) accommodation of teacher competencies, (10) accommodation for student participation, and (11) providing for measurement of achievement. After defining the variables, Torgunrud generated a sample of 100 profiles, each described by Naylor and Wherry (22) for simulating stimuli with specified factor structure. An example of a typical profile appears below:

Sample Curriculum Package

Descriptors	Weak			Average				Strong	
	1	2	3	4	5	6	7	8	9
1. Valid and significant content				4					
2. Significant elements of organization					5				
3. Sequence providing a cumulative effect							7		
4. Integrating providing horizontal relationships						6			
5. Value position clearly stated			3						
6. Specificity providing direction								8	
7. Flexibility providing alternatives									9
8. Accommodation of student differences						6			
9. Accommodation of teacher competencies				4					
10. Accommodation for student participation								8	
11. Providing for measure of achievement			3						
Judge's Overall Rating of Curriculum Package (Circle only one)	Weak 1	2	3	Average 4	5	6	7	Strong 8	9

Each of the participating judges (school superintendents) was requested to rate or rank each of the sample curriculum packages. The JAN procedures enabled the investigator to determine the relationships of the set of independent variables to the judge's specific policy relative to curriculum packages. In addition, a determination was made on how many different evaluation policies were actually present, who were the members expressing each policy, and what were the areas of agreement and disagreement in the different policies.

In another evaluation study at the University of California at Los Angeles, Duff (10) utilized JAN techniques to capture both the teacher-hiring policies (Ex Ante) of selected administrators and the administrators' evaluation policies (Ex Post) of teachers' on-the-job performance after their first year of paid teaching experience. Both types of policies (hiring and job performance) were analyzed in terms of predictive validity by the investigator.

The concept of a group or collective judge was introduced in a study by Houston and Gilpin (17) and in a follow-up study by Houston et al. (16) in which the investigators sought to capture the evaluation policies of selected groups of students who were rating faculty members at the University of Northern Colorado. Rather than use each student as a separate judge, students were classified by their grade level and by the school or college in which they were enrolled as a major. A copy of the instrument presented to the student is as follows:

Teacher Description Instrument

Please rate only this teacher in this particular course in accordance with this rating scale
1) Poor 2) Fair 3) Average 4) Good 5) Excellent

1. Teacher's interest and enthusiasm for course	1	2	3	4	5
2. Ability to answer questions adequately	1	2	3	4	5
3. Ability to communicate the subject matter effectively	1	2	3	4	5
4. Ability to interest and motivate students	1	2	3	4	5
5. Fairness in testing and grading	1	2	3	4	5
6. Personal interest and adaptation to student's needs	1	2	3	4	5
7. Course Objectives are clearly stated	1	2	3	4	5
8. Course objectives are met	1	2	3	4	5
9. Everything considered, including strengths and weaknesses, I would rate the instructor	1	2	3	4	5

The first eight items of the TEACHER DESCRIPTION INSTRUMENT were considered independent variables and item nine was treated as the dependent variable in the regression analyses which were completed. This study departed from other JAN studies not only in the use of a group judge but also in the use of the students to generate the profile scores (normally each judge receives a fixed set of profiles to rate or rank). In the first JAN study (JAN I) the students were grouped by five grade levels thus permitting the use of five judges in the JAN analysis. The judges for the JAN I study included: Judge 1--Freshman students; Judge 2--Sophomore students; Judge 3--Junior students; Judge 4--Senior students; and Judge 5--Graduate students. In

the second JAN study (JAN II) the students were identified in terms of the seven schools or colleges at the University of Northern Colorado. The judges for the JAN II study included: Judge 1--Students from School of the Arts; Judge 2--Students from College of Arts and Sciences; Judge 3--Students from School of Business; Judge 4--Students from College of Education; Judge 5--Students from School of Health, Physical Education, and Recreation; Judge 6--Students from School of Music; and Judge 7--Students from School of Nursing. In both studies it was found that only one policy was present. The overall rating of the faculty member was primarily a function of variables 3,4, and 6.

Teacher effectiveness policies of faculty members were captured in a study by Houston and Broderius (15). Profiles of sixty hypothetical faculty members were generated in which each faculty member was described in terms of teaching skills, student advising skills, institutional service, and professional activities. Three policies were found to exist in the faculty members who participated in the study.

Another potential application of JAN techniques is in the area of program evaluation, especially in the case involving the use of evaluation experts rendering professional judgments. Two research studies are described by Houston and Bentzen (14) and Houston et.al. (18) in which JAN was used as part of the summative evaluation of the projects. Both programs relied on the expertise of educational evaluation experts who were required to make ratings on several dimensions or variables describing the school or classroom program. These variables were later used as independent predictors of the dependent variable (which was an overall rating of the school or classroom program) in the policy statement of each judge which was captured with the aid of JAN. With the assistance of JAN procedures the investigators were able not only to capture the evaluation policies present in the team of evaluation experts but also able to determine which of the independent variables were making significant contributions to the overall success of the projects. Instead of providing much input and output information separately, JAN was able to tie together and relate those input aspects of the project responsible for the ultimate impact of the program. Indeed, JAN can and does provide another dimension to program evaluation and is recommended for consideration in programs which rely heavily on professional judgments of experts in the final evaluation.

5. Evaluation of Research Proposals and Judgment Analysis

A very basic question in the evaluation of research proposals seeking funds is to determine which proposals should get supported. In answering this question a typical starting point is often to ask the team of evaluators to rate each proposal on a set of characteristics. An example of such a set of characteristics for proposals at the National Cancer Institute on which a team of evaluators would rate was presented by Dr. John C. Bailar, III, Deputy Director for Cancer Control, National Cancer Institute (The dimensions or characteristics identified include: (1) need, (2) relevance, (3) feasibility, (4) number benefitted, (5) how much they would benefit, (6) acceptability, (7) potential, (8) cost benefit, (9) ease of evaluation, and (10) originality. A question often left unanswered (or answered inadequately) when data are available which are descriptive of a specific proposal, is how are each of the ten dimensions to be weighted in making a decision to fund or not to fund the project.

A strategy for utilizing JAN in this situation would be to start with the set of 10 characteristics or dimensions and generate a simulated sample of approximately 200 representative proposals possessing a required factor structure. (See the dissertation of Torgunrud (25) and the article of Naylor and Wherry (22) for a description of the procedure required to generate simulated stimuli. However, other approaches are available depending on the avilability of stimuli and the requirements of the factor structure.) Have each of the officials involved in the decision-making process rate each of the 200 proposals. An extremely difficult assignment for the official (who serves as judge or rater) would be the assignment that he rank order the complete set of 200. A more reasonable and practical request would be for each judge to place each of the 200 proposals into different ordered categories (usually a minimum of five). While original studies involving JAN requested each judge to rank order the complete set of profiles or proposals, experience with the technique has suggested that JAN is still quite effective when the assignment involves the placing of profiles into ordered categories, even as few as five categories. Judges find it too difficult to rank order a large sample of stimuli and they typically have little difficulty in making an assignment involving a few ordered categories.

An example of a sample proposal or profile described on the 10 characteristics appears below:

Sample Research Proposal

Descriptors	Weak 1 2 3	Average 4 5 6 7	Strong 8 9
1. Need		 7	
2. Relevance		 6	
3. Feasibility	. . 3		
4. Number benefitted		. . . . .	8
5. How much they would benefit		 4	
6. Acceptability		 5	
7. Potential		. . . . .	8
8. Cost benefit		 4	
9. Ease of evaluation		 5	
10. Originality		 7	
Judge's Overall Rating of Proposal (Circle only one)	Weak 1 2 3	Average 4 5 6 7	Strong 8 9

After each of the officials serving as judges has completed the rating assignment for the 200 simulated stimuli, begin the JAN analysis. For a description of the computer program for JAN, see Vlahos and Houston (26). From the JAN print-out and using the recommendations by Ward and Hook (28) for determining the number of policy groupings, identify the number of captured policies and the judges associated with each of the policies. Using the knowledge of how many policies are present and who are the judges in the different policy groupings, the investigator should then attempt to explain each of the captured policies. A variety of approaches have been used to explain the different policies. These approaches, depending on the research question and the factor structure relating the set of independent variables, include path analysis (32), principal components analysis (7), stepwise regression analysis (8), setwise regression analysis (31), subjective hierarchical analysis (17), all possible

regressions (8), the backward elimination procedure or unique contribution analysis (8,27), the forward selection (8) and the stagewise regression procedure (8).

Return to the judges gathered together and explain the different policies with particular emphasis on areas of agreement and disagreement. At this point identify specifically the profiles whose varied rankings resulted in the separate policies which were captured. Ask the group to arbitrate the rankings where differences have occurred, and not the weightings to be applied to the independent variables. After the group agrees on the rankings for the simulated proposals complete a new regression analysis using the new rankings as the dependent variable and thereby obtain the proper weights associated with the joint policy.

5. Summary

Judgment ANalysis (JAN) was described as a vehicle for capturing policy (ies) present in a group of decision-makers. Several studies were presented which strongly support consideration of its use in the area of making definitions explicit as well as a technique for evaluating program and research proposals. Examples of how the JAN methodology might be applied to proposal and program evaluation were illustrated.

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